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Rio de Truchas Riparian Monitoring Study Report 2005

Prepared for:
U.S. Department of the Interior
Bureau of Land Management
Farmington District Office
Taos Field Office
Taos, New Mexico

Prepared by:
U.S. Department of the Interior
Bureau of Reclamation
Technical Service Center
Environmental Services Division
Fisheries & Wildlife Resources Group
Denver, Colorado

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Rio de Truchas
Riparian Monitoring Study Report

prepared by

Rebecca Siegle, Natural Resources Specialist

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Bureau of Reclamation
Denver, Colorado

U.S. Department of the Interior
Bureau of Reclamation
Technical Service Center
Environmental Services Division
Ecological Planning and Assessment
Denver, Colorado

May, 2006

Mission Statements

The mission of the Department of the Interior is to protect and provide access to our Nation's natural and cultural heritage and honor our trust responsibilities to Indian Tribes and our commitments to island communities.

The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.

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INTRODUCTION

The Bureau of Reclamation began riparian monitoring within Bureau of Land Management (BLM), Taos Field Office's Rio de Truchas grazing allotment in October of 2003. The Rio de Truchas is a tributary of the Rio Grande, located east of Highway 68, south of the town of Velarde, New Mexico (Figure 1). This report summarizes the information that has been collected to date in association with this study.

The purpose of monitoring was to assess the impacts of winter/spring grazing on riparian health. The U.S. Fish and Wildlife Service's Biological Opinion for the Southwestern Willow Flycatcher in the Taos Resource Area (1997) defines the Rio de Truchas area as potential short-term habitat (1-3 yrs) for the endangered southwestern willow flycatcher. As such, the Biological Opinion recommended that the impacts of winter grazing during the dormant season in riparian habitats be evaluated. These recommended studies "should assess whether riparian vegetation has had time to become established and has grown to sufficient size to withstand grazing pressures."

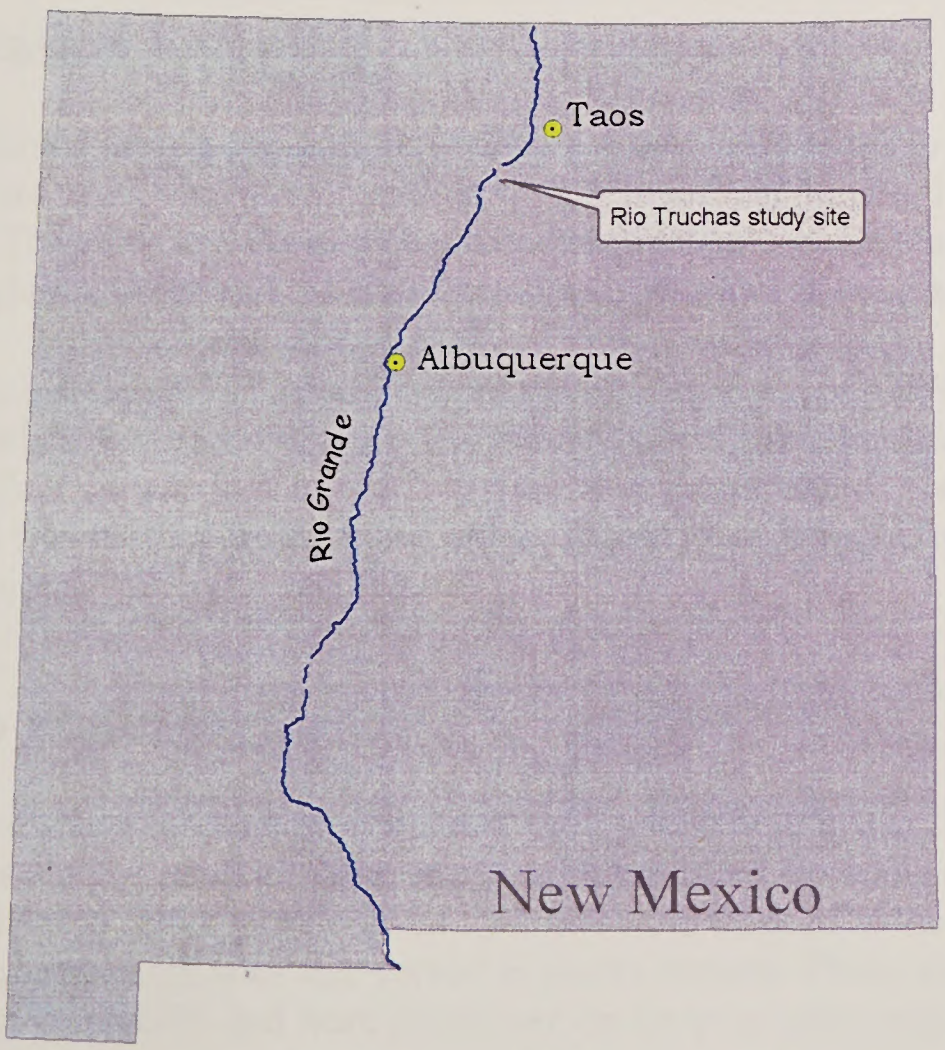


Figure 1. Location map.

The elements involved and the purposes for including them in the Rio de Truchas monitoring program were as follows:

Vegetation mapping - The existing conditions documented can be used to compare future conditions and to document changes within the riparian vegetative community.

Photo stations - The images captured document the temporal condition of woody species and herbaceous vegetation and provide a visual comparison of the vegetative communities within and outside the temporary livestock exclosures.

Vegetation monitoring - Livestock exclosures were used to provide an ungrazed condition inside exclosures to compare to grazed conditions outside.

Soil moisture/groundwater monitoring - Measurements used to correlate available water to plant growth were expected to provide information on factors other than grazing that influence the health of riparian vegetation.

METHODS

Vegetation mapping

Aerial photos and on-the-ground verification were employed to identify polygon boundaries using vegetation types from the Hink and Ohmart (1984) classification system. The Hink and Ohmart Classification system includes the relative abundance of woody plant species and the characteristic structure of the plants within a community.

The Trimble Geo XT Explorer Global Positioning System (GPS) unit was used to record the boundaries of each polygon. The percent cover and size classes of the dominant woody plant species within each polygon were documented. The information gathered in the field was used to create a map of vegetation types using ARC/INFO Geographic Information System (GIS) software.

Photo stations

Permanent photo stations were established by installing metal T-posts at selected locations where potential, developing and established riparian conditions existed. Existing photo stations established by BLM were utilized to the extent possible. Livestock exclosure sites also served as photo stations. Photo station locations were identified using GPS and were positioned on a topographic map (Figure 2). GPS waypoints and narrative descriptions of photo station locations are provided in Appendix A.

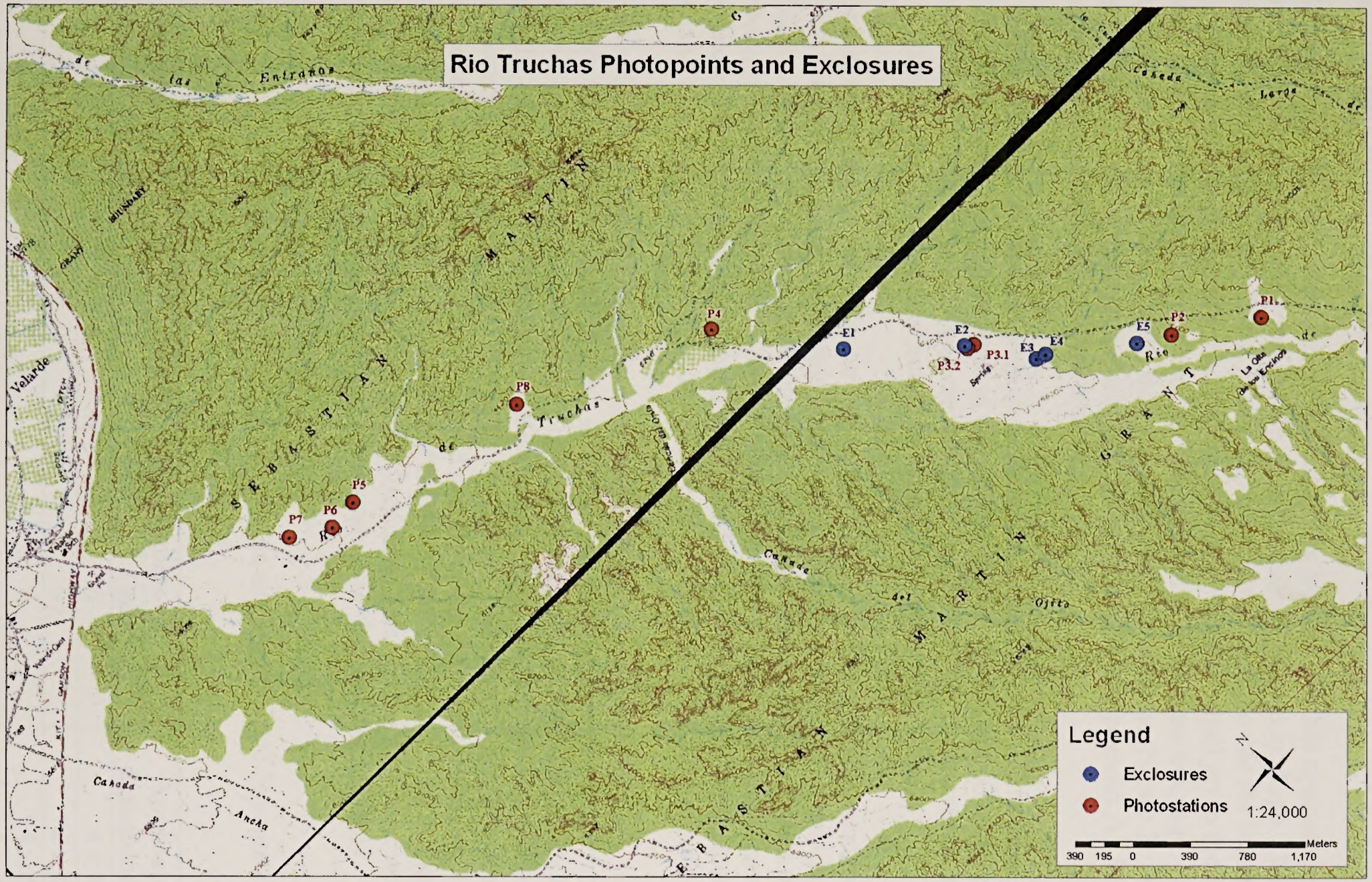


Figure 2. Photo point and exclosure locations.

Vegetation monitoring

Temporary livestock exclosures were installed at five locations within riparian areas. Four of the exclosures were approximately 16 m^2 in size and square in shape. The other exclosure was approximately 10 m^2 in size and rectangular in shape due the linear nature of the riparian habitat at that site. The exclosures were relatively small given the limited physical extent of the existing riparian zone along the Rio de Truchas drainage. Locations of the exclosures are included in the map showing the photo stations (Figure 2). Actual waypoints and narrative descriptions of locations are included in Appendix A. Photo stations were also established at exclosure sites.

The exclosures were constructed to exclude only livestock. Native wildlife (deer, rabbits, etc.) that feed on the riparian vegetation were not excluded. It was assumed that native species would utilize the woody vegetation within and outside the exclosures in equal proportions and that the effects of native browsing would be insignificant.

Permanent one meter micro-plots were established inside and outside of the exclosures in areas that supported similar vegetation composition, height, density, and hyrdrologic conditions. The micro-plots outside the exclosures were located along transects that were permanently marked with metal T-posts. Metal pins were used to mark the corners of all micro-plots. The number of micro-plots established within and outside the exclosures is shown in Table 1, along with approximate dimensions of each of the exclosures.

All narrowleaf cottonwood (*Populus angustifolia*), Rio Grande cottonwood (*P. deltoides*), coyote willow (*Salix exigua*), and bluestem willow (*S. irrorata*) were counted and measured to determine the frequency of browse (percent of individual plants browsed outside the exclosure), the average height and density, and the species composition. Percent cover of herbaceous species was also collected. These data were then analyzed to test for statistical differences in height and density of the dominant woody species and the herbaceous cover between the inside and outside of the exclosures. The Student's t-test of means was used to compare normally distributed data and the non-parametric Mann-Whitney test of medians was used to compare data that was not normally distributed.

Table 1. The number of micoplots inside and outside and approximate dimensions of exclosures.

Exclosure	Number of microplots		Approximate dimensions (m)
	In	Out	
1	6	8	4 x 4
2	9	9	4 x 4
3	9	9	4 x 4
4	9	10	4 x 4
5	10	10	2 x 5

Soil moisture/ groundwater monitoring

The Delmhorst soil moisture measuring system was originally used to test soil moisture. Because we experienced difficulties with this method of data collection at this particular site, and because our findings were uncertain, we decided to discontinue soil moisture monitoring in November of 2004. Instead, shallow monitoring wells were installed in August of 2005 at each exclosure site using methodology developed by the U.S. Army Corp of Engineers (Sprecher, 2000). These groundwater monitoring wells provide information on the depth and movement of the water table within the soil profile.

Holes were augered for each well to the depth needed to reach groundwater. Two inch diameter PVC pipe/slotted well screen (0.010" slots) were placed in the hole with a riser (unslotted PVC pipe) that extended from the top of the well screen to above the ground surface. Silica sand (20-40 sand) was placed in the hole around the slotted portion of the pipe to help filter out clays and silts. Approximately 4" of bentonite clay was placed on top of the sand, immediately below the ground surface along with a mound of soil and bentonite above ground to form a seal to prevent surface water from entering the well. All wells were capped with PVC caps to protect the wells from surface water flows and precipitation. Water levels in each well were measured (monthly) from the tip of riser to the water surface. A correction was made for the difference between riser elevation and ground elevation to determine depth to water table.

RESULTS AND DISCUSSION

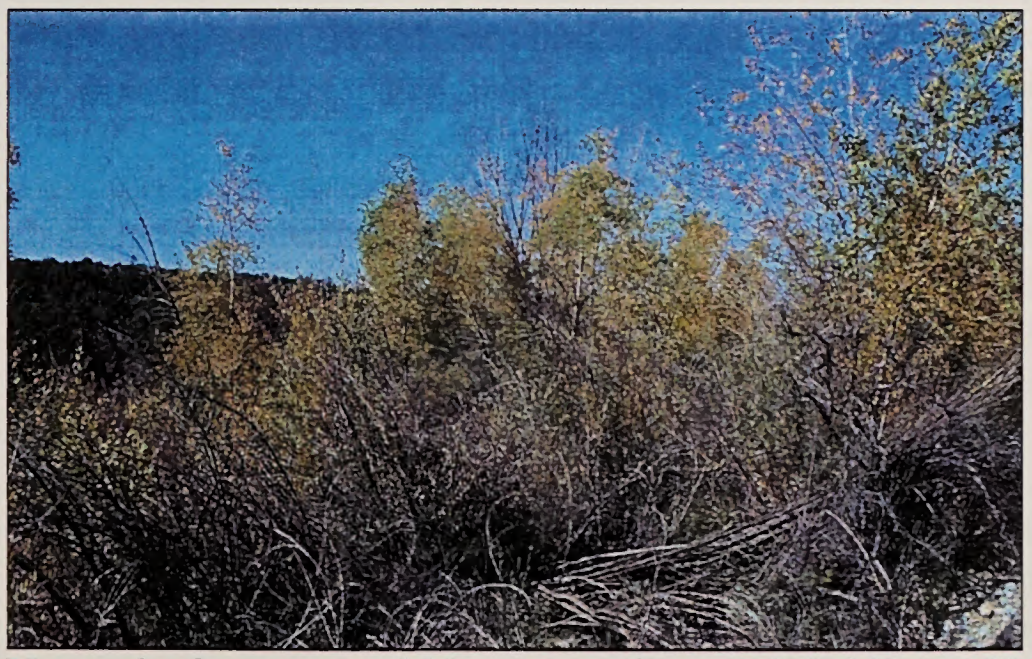
Vegetation mapping

The riparian zones from the upstream boundary of BLM lands to 2.7 kilometers downstream of the Rio de Truchas drainage were mapped in October of 2004. The mapping effort did not extend any further downstream because the quality of riparian habitat decreases as the stream channel turns into a more open and less vegetated arroyo. The resulting site map is shown in Appendix B. Acreages of each habitat type are also quantified on the map. Photos showing examples of selected vegetation types are shown in Figure 3.

The Rio de Truchas is an ephemeral stream that is commonly dry in many reaches. The upstream section of the drainage that was mapped is relatively narrow, with linear strips of vegetation along the channel. Various springs support broader patches of riparian habitat. This reach of the Rio de Truchas is a relatively healthy ecosystem composed of predominantly native species. Dominant native woody plant species were narrowleaf cottonwood, Rio Grande cottonwood, coyote willow, bluestem willow, and thinleaf alder (*Alnus incana*). The introduced woody species Russian olive (*Elaeagnus angustifolia*) was common at the downstream reach of the mapping zone, but was not present

Open area, cover < 25% (OP)

Coyote willow, 5-15 ft, >75% cover (CW5F)



Narrowleaf cottonwood-bluestem willow, 0-5 ft (NLC-BSW6)

Figure 3. Examples of vegetation types used in mapping.

upstream. There was no obvious damage from livestock grazing within the mapped areas.

Photo stations

Photographs were taken at all photo stations and exclosures in October 2003, 2004 and 2005. Comparisons of photos captured in 2003 and 2005 are shown in Appendix C. In some of the photos, vegetation appeared to have grown over the two years, presumably due to high precipitation in 2005, as there were no obvious differences in photos between 2003 and 2004. Over time, changes in vegetation should become even more evident.

Vegetation monitoring

In October, 2003 and 2005 vegetation inside and outside of the livestock exclosures was measured. The data that was collected is summarized in Table 2. There was no evidence of livestock browsing on any of the plants outside of the exclosures.

The study plan originally included monitoring in both spring and fall to capture conditions before and after grazing activity on an annual basis. Unexpectedly, grazing has not occurred since vegetation monitoring was initiated. Therefore only vegetation baseline data was collected in October of 2003 and 2005. Under these circumstances, we were unable to statistically compare pre- and post-grazing data to determine if there was a significant difference in vegetation parameters. We did statistically compare height, density, and cover within each of the exclosures to that outside for a measure of baseline conditions. Results are shown in Table 3. In most cases, height and density of woody species and cover of herbaceous species inside the exclosures was statistically equal to height and density outside, which simplifies analysis if future monitoring is conducted. The exceptions in 2003 were at Exclosure 1, where the height of coyote willow, total density, and herbaceous cover inside the exclosure was significantly greater than that outside, at Exclosure 3, where herbaceous cover was statistically greater inside than out, and at Exclosure 5, where the height of bluestem willow inside was significantly less than out. In 2005, differences were found at Exclosure 1, where the height of coyote willow was statistically greater inside the exclosure than out, and at Exclosure 3, where total density inside was significantly greater than out. These differences were not consistent between the two years, except in the case of coyote willow height at Exclosure 1, which suggests that variables other than grazing were affecting vegetation. If grazed and ungrazed conditions are compared in the future, we would need to account for these differences in the baseline data.

We also compared 2003 and 2005 data to see if recent climatic changes had a significant effect on vegetation between the years. The first collection period fell during several years of drought conditions and effects from this drought were evident in dead and dying

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Table 2. Exclosure data (np = not present).

Exclosure	Avg. % Herb. cover 2003	2005	Avg. Total Density 2003	2005	Avg. Ht. Rio Grande cottonwd 2003	2005	Avg. Ht. Narrow leaf cottonwd 2003	2005	Avg. Ht. Coyote willow 2003	2005	Avg. Ht. Bluestem willow 2003	2005
1 In	45	17	60	52	np	np	np	np	183	246	144	233
Out	11	41	25	26	np	np	np	np	148	200	125	173
2 In	100	94	8	8	np	np	np	np	119	165	np	np
Out	98	88	8	8	np	np	np	np	132	170	np	np
3 In	72	57	56	87	45	np	np	243	np	np	48	77
Out	52	57	42	51	49	133	np	np	np	np	45	71
4 In	100	85	13	12	np	np	np	np	162	222	np	np
Out	100	80	15	12	np	np	np	np	164	239	np	np
5 In	1	2	36	53	np	np	62	74	np	np	61	73
Out	2	4	39	48	np	np	60	77	41	np	71	89

Table 3. Statistical comparisons of baseline vegetation inside and outside of Exclosures 1-5. Alpha = 0.05

	Exclosure 1		Exclosure 2		Exclosure 3		Exclosure 4		Exclosure 5	
	2003	2005	2003	2005	2003	2005	2003	2005	2003	2005
Herbaceous cover	In > Out P<0.001	In = Out P=0.137	In = Out P=0.150	In = Out P=0.176	In > Out P=0.032	In = Out P=0.947	In = Out P=1.00	In = Out P=0.357	In = Out P=0.234	In = Out P=0.082
Total Density	In > Out P=0.032	In = Out P=0.076	In = Out P=0.803	In = Out P=0.928	In = Out P=0.051	In > Out P=0.001	In = Out P=0.585	In = Out P=0.873	In = Out P=0.742	In = Out P=0.472
Height Rio Grande cottonwood	None present	None present	None present	None present	In = Out P=0.737	None present (In)	None present	None present	None present	None present
Height narrowleaf cottonwood	None present	None present	None present	None present	None present	None present (Out)	None present	None present	In = Out P=0.863	In = Out P=0.762
Height coyote willow	In > Out P=0.042	In > Out P=0.002	In = Out P=0.316	In = Out P=0.077	None present	None present	In = Out P=0.919	In < Out P=0.043	None present	None present
Height bluestem willow	In = Out P=0.505	In = Out P=0.172	None present	None present	In = Out P=0.325	In = Out P=0.432	None present	None present	In < Out P<0.001	In = Out P=0.216

vegetation along the stream channel. Precipitation in 2005 was above average, and based on observation, there was a substantial increase in height and density of vegetation as a response to the wet conditions. This observation was supported statistically in a number of cases where 2005 height and density were significantly greater than 2003 (Table 4). These cases include: total density inside Exclosures 3 and 5; Rio Grande cottonwood height outside of Exclosure 3; coyote willow height inside and outside of Exclosures 1, 2, and 4; and bluestem willow height inside Exclosures 3 and 5 and outside of Exclosures 1 and 3. Herbaceous cover, on the other hand, was significantly less in 2005 than in 2003 in many instances. Cover decreased over time inside of exclosures 1,2, and 4 and outside of exclosures 2 and 4. This decrease in herbaceous cover can probably be attributed to an increase in overstory vegetation, which would increase shading at the ground level. Also, longer periods of flooding could have created conditions unfavorable for many species of herbaceous plants to survive.

Groundwater monitoring

Groundwater levels were measured in most months from August 2005 through March 2006 along the stream channel to document changes in hydrology throughout the year. The results of the well monitoring are graphed in Appendix D. In general, the water table has risen since installing the wells. The groundwater well at Exclosure 1 was commonly dry, and there were a few times that the well at Exclosure 5 was dry. Water levels were consistently at the soil surface at Exclosure 4 following installation of the well.

RECOMMENDATIONS

Vegetation mapping

We suggest mapping the entire Rio de Truchas drainage from the point where vegetation mapping was concluded to the highway downstream. We did not map these riparian areas of lesser habitat quality, but a record of the vegetation may be helpful for future comparisons of trends within this reach.

Photo stations

We recommend continuing to capture images at established photo stations and exclosures in or around October of each year. It would be helpful to identify any changes that may have already occurred along the Rio de Truchas if photos taken in the past by BLM were compared to photos displayed here for those stations that remained in the same location. We advise maintaining one set of electronic copies of all photos taken within the Rio de Truchas study area and including BLM's photos in future monitoring reports.

Table 4. Statistical comparisons of baseline vegetation between years 2003 and 2005 inside and outside of Exclosures 1-5. Alpha = 0.05

Exclosure	In						Out					
	Herb. cover	Total Density	Ht. Rio Grande cottonwd	Ht Narrow leaf cottonwd	Ht Coyote willow	Ht Bluestem willow	Herb. cover	Total Density	Ht. Rio Grande cottonwd	Ht Narrow leaf cottonwd	Ht Coyote willow	Ht Bluestem willow
1	03 > 05 P=0.007	03 = 05 P=0.711	None present	None present	03<05 P=0.001	03 = 05 P=0.098	03 < 05 P=0.039	03 = 05 P=0.891	None present	None present	03 < 05 P=.002	03 < 05 P=0.037
2	03 > 05 P=0.025	03 = 05 P=0.740	None present	None present	03 < 05 P=0.001	None present	03 > 05 P=0.019	03 = 05 P=0.972	None present	None present	03 < 05 P=<0.001	None present
3	03 = 05 P=0.066	03 < 05 P<0.001	None present	None present	None present	03 < 05 P<0.001	03 = 05 P=0.597	03 = 05 P=0.303	03 < 05 P=0.044	None present	None present	03 < 05 P<0.001
4	03 > 05 P=0.003	03 = 05 P=0.712	None present	None present	03 < 05 P<0.001	None present	03 > 05 P<0.001	03 = 05 P=0.292	None present	None present	03 < 05 P<0.001	None present
5	03 = 05 P=0.051	03 < 05 P=0.016	None present	03 = 05 P=0.092	None present	03 < 05 P<0.001	03 = 05 P=0.091	03 = 05 P=0.245	None present	03 = 05 P=0.130	None present	03 = 05 P=0.192

Vegetation monitoring

If grazing resumes within the Rio de Truchas grazing allotment during future rotations, we recommend that vegetation be measured at the exclosure sites in the fall, prior to the next grazing rotation. This collection period would provide up-to-date pre-grazing data to compare to post-grazing conditions. Vegetation should also be measured following the next grazing rotation to provide post-grazing data for comparison purposes.

Groundwater monitoring

If future hydrologic studies are desired at the Rio de Truchas site, we suggest deepening monitoring wells 1 and 5 and continuing to collect hydrology data regularly to chronicle water table levels.

LITERATURE CITED

Hink, Valerie C. and Robert D. Ohmart. 1984. Middle Rio Grande Biological Survey. U.S. Army Corps of Engineers Contract Number: DACW 47-81-C-0015.

Sprecher, S.W. (2000). Installing Monitoring Wells in Wetlands, WRAP Technical Notes Collection (ERDC TN-WRAP-00-02), U.S. Army Engineer Research and Development Center, Vicksburg, MS.

APPENDIX A

Photo Point and Exclosure Locations

Rio de Truchas Photopoints and Exclosures:

All photopoints were marked with T posts unless otherwise noted, GPS locations are in NAD 27 Conus UTMs. Midchannel photos are from approximate midpoint of active channel adjacent to photopoint.

P1 – 418788 E 3995804 N – photos taken upstream, downstream and across channel

P2 – 418276 E 3996148 N – photos taken upstream and downstream

P3.1 – 417275 E 3997053 N – 2 photos taken downstream toward sheep pen from buried tank, no T post marker

P3.2 – 417221E 3997045N – T post approximately 230 meters south of P3.1, adjacent to active channel on south side– photos taken upstream, downstream, and across channel

P4 – 416078 E 3998388 N – 5 meters from current road location, photos taken from cut bank – photos taken upstream, downstream, across channel, and midchannel upstream

P5 – 413503 E 3999289 N – immediately below lower BLM exclosure on north side of wash – photos taken upstream, downstream, across channel, and midchannel upstream

P6 – 413288 E 3999265 N – on south side of wash, road location changed since 1998 – photos taken upstream, downstream, across channel and midchannel upstream

P7 – 413033 E 3999426 N – on north side of wash – photos taken upstream, downstream, across channel and midchannel upstream

P8 – 414769 E 3998973 N – approximately 15 meters from road, located 0.9 mi east of P4 and 0.8 mi west of P5 – photos taken upstream, downstream, across channel and midchannel upstream

Exclosure 1 – 416623E 3997658N– all photos from T post north of the exclosure.

Exclosure 2 – 417221 E 3997095 N - photo from T post south of the exclosure.

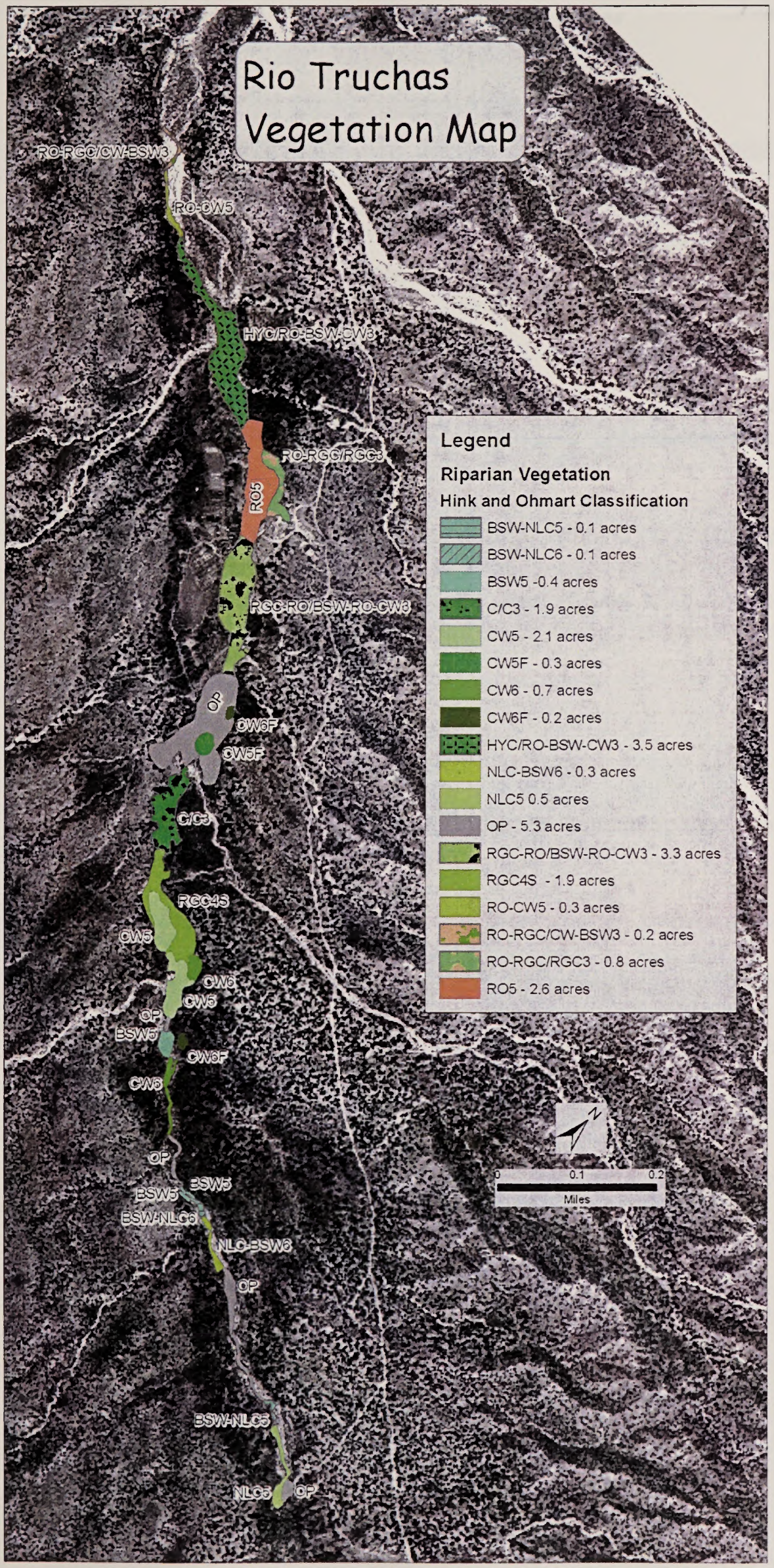
Exclosure 3 – 417504 E 3996682 N - photo from T post southeast of the exclosure.

Exclosure 4 – 417572 E 3996661 N - photo from T post on terrace northeast of the exclosure.

Exclosure 5 – 418066 E 3996272 N - 1 photo of T post at the transect east of the exclosure, 1 photo of exclosure from T post at west transect, and 1 photo downstream from west transect T post.

APPENDIX B

Vegetation map and classification codes


Rio Truchas
Vegetation Map
RO-RGC/CW-BSW3
RO-CW5
HYC/RO-BSW-CW3
RO-RGC/RGC3
RO5
RGC-RO/BSW-RO-CW3
OP
CW6F
CW5F
C/C3
RGC4S
CW5
CW6
CW5
OP
BSW5
CW6F
CW5
OP
BSW5
BSW5
BSW-NLC6
NLC-BSW6
OP
BSW-NLC5
NLC5
OP
Legend
Riparian Vegetation
Hink and Ohmart Classification
BSW-NLC5 - 0.1 acres
BSW-NLC6 - 0.1 acres
BSW5 -0.4 acres
C/C3 - 1.9 acres
CW5 - 2.1 acres
CW5F - 0.3 acres
CW6 - 0.7 acres
CW6F - 0.2 acres
HYC/RO-BSW-CW3 - 3.5 acres
NLC-BSW6 - 0.3 acres
NLC5 0.5 acres
OP - 5.3 acres
RGC-RO/BSW-RO-CW3 - 3.3 acres
RGC4S - 1.9 acres
RO-CW5 - 0.3 acres
RO-RGC/CW-BSW3 - 0.2 acres
RO-RGC/RGC3 - 0.8 acres
RO5 - 2.6 acres
N
0
0.1
0.2
Miles

Classification codes

Vegetation codes

Code	Common name	Scientific name
BSW	Bluestem willow	*Salix irrorata*
CW	Coyote willow	*Salix exigua*
HYC	Lanceleaf cottonwood (hybrid)	*Populus* X *acuminata* (*P.deltoides* x *P. angustifolia*)
NLC	Narrowleaf cottonwood	*Populus angustifolia*
OP	Open area (<25% woody spp.)	
RGC	Rio Grande cottonwood	*Populus deltoides*
RO	Russian olive	*Elaeagnus angustifolia*

Plant species are recorded according to the relative abundance of the species cover within two layers. The most abundant species (over 25% cover) is listed first and other species (if over 25% cover) are listed in order of abundance. Species within a layer are separated by a "-". Canopy and understory layers are separated by a "/". Typically one or two species are recorded for each layer, but as many species as qualify are recorded (up to 4).

Structural classes

Type	Height	Description
1	>40 ft (12.2 m)	Mature & mid-age stands w/ well-developed understory at all heights
2	>40 ft (12.2 m)	Mature overstory trees w/ little or no understory
3	20-40 ft (6.1-12.2 m)	Intermediate-sized trees w/ dense understory
4	20-40 ft (6.1-12.2 m)	Intermediate-sized trees w/ no understory
5	5-15 ft (1.5-4.6 m)	Younger stands w/ dense shrubby growth
6	0-5 ft (1.5 m)	Very young, low, and/or sparse stands

Density codes

Code	Description
S	Vegetation cover <50%
F	Vegetation cover >75%

APPENDIX C

Comparison of photos

October 2003 and 2005

Exclosure 1 – Downstream

2003

2005

Exclosure 1 - Upstream

2003

2005

Exclosure 1

2003

2005

Exclosure 2

2003

2005

Exclosure 3

2003

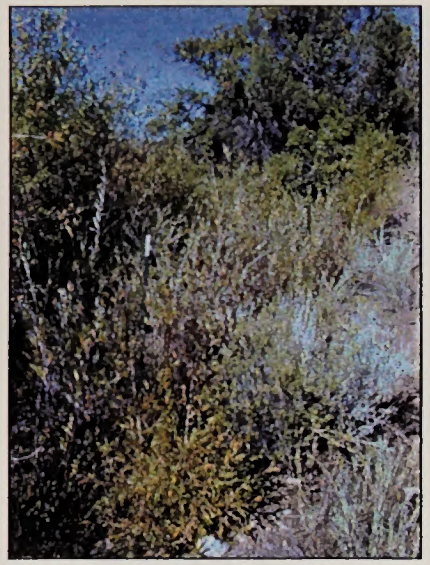
2005

Exclosure 4

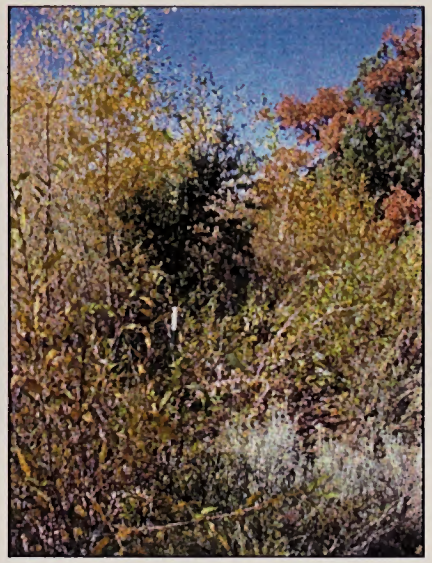
2003

2005

Exclosure 5 – East transect



2003



2005

Exclosure 5 – West transect

2003

2005

Exclosure 5

2003

2005

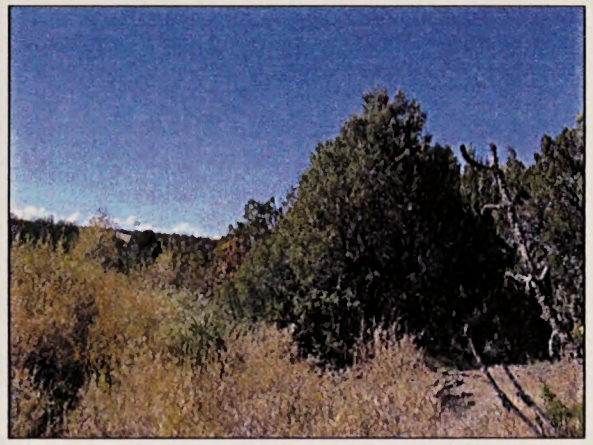
P1 – Across channel

2003

2005

P1 – Downstream

2003



2005

P1 – Upstream

2003

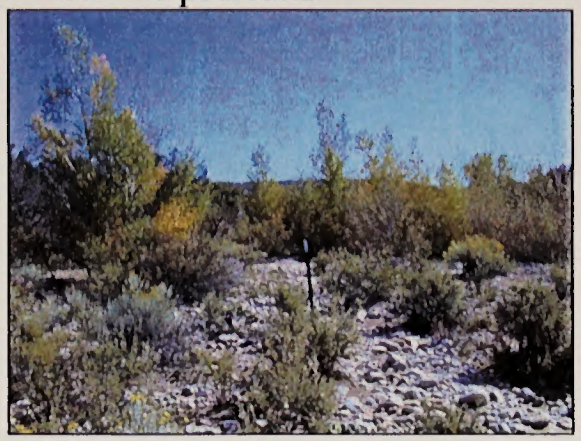
2005

P2 – Downstream

2003

2005

P2 – Upstream



2003

2005

P3.1 – Sheep pen

2003

2005

P3.2 – Across channel

2003

2005

P3.2 – Downstream

2003

2005

P3.2 – Upstream

2003

2005

P4 – Across channel

2003

2005

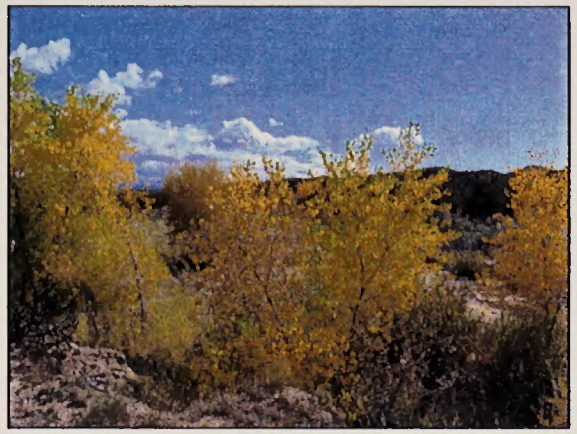
P4 – Downstream

2003

2005

P4 – Upstream

2003



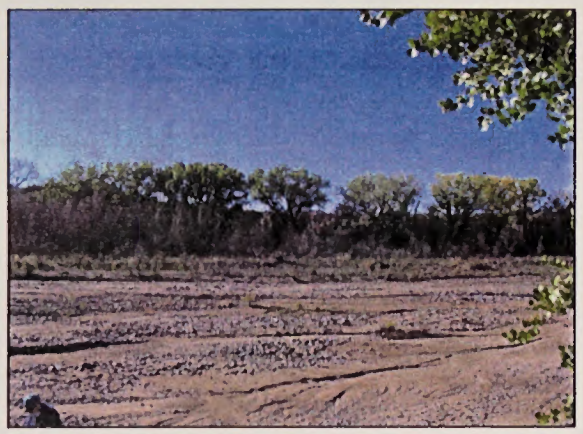
2005

P4 – Midchannel upstream

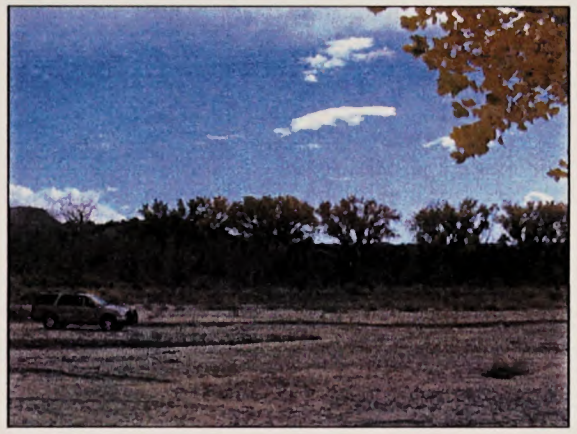
2003

2005

P5 – Across channel



2003



2005

P5 – Downstream

2003

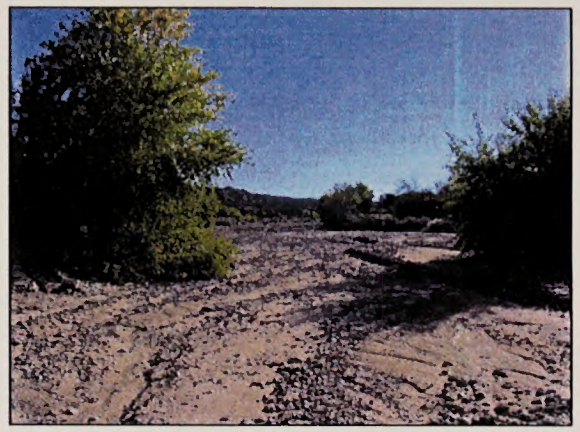
2005

P5 – Upstream

2003

2005

P5 – Midchannel upstream



2003

2005

P6 – Across channel

2003

2005

P6 – Downstream

2003

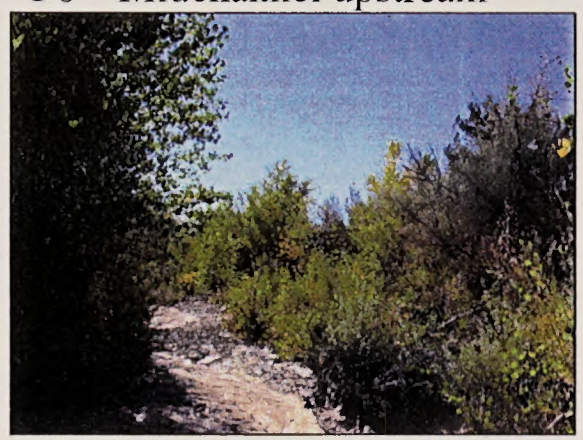
2005

P6 – Upstream

2003

2005

P6 – Midchannel upstream



2003

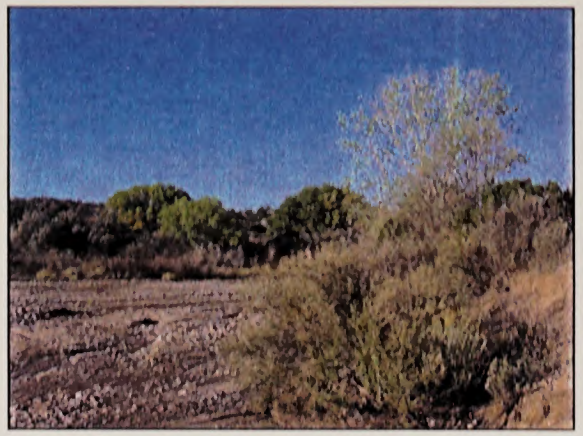
2005

P7 – Across channel

2003

2005

P7 – Downstream



2003

2005

P7 – Upstream

2003

2005

P7 – Midchannel upstream

2003

2005

P8 – Across channel

2003

2005

P8 – Downstream

2003

2005

P8 – Upstream

2003

2005

P8 – Midchannel upstream

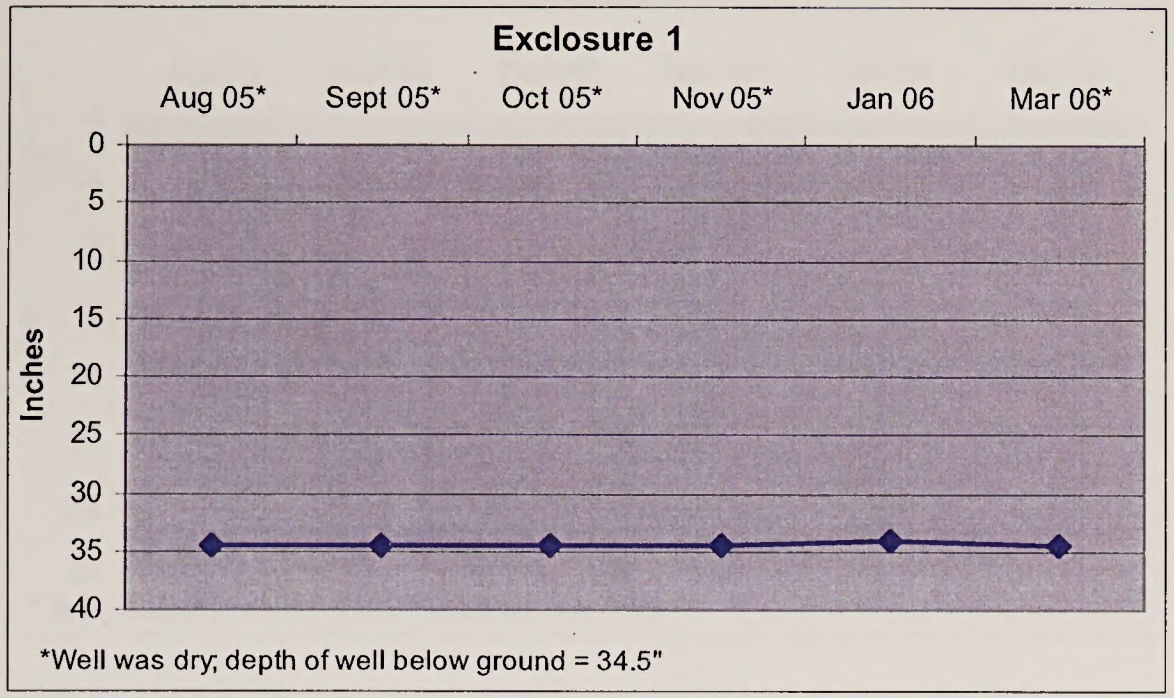
2003

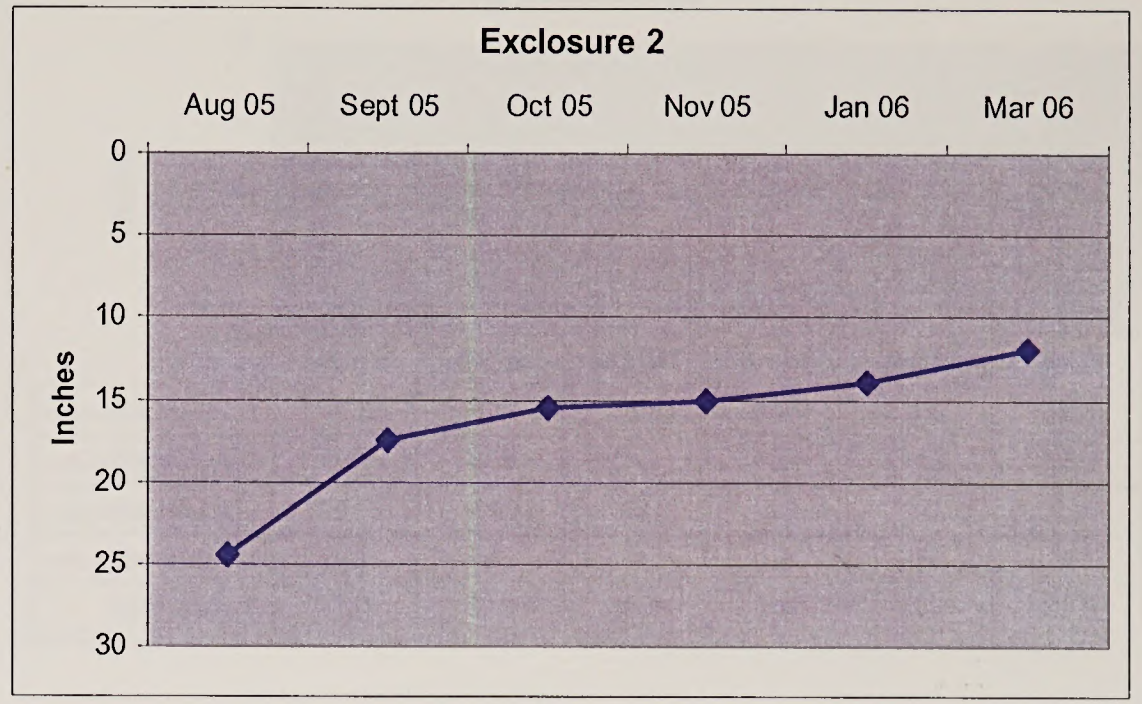
2005

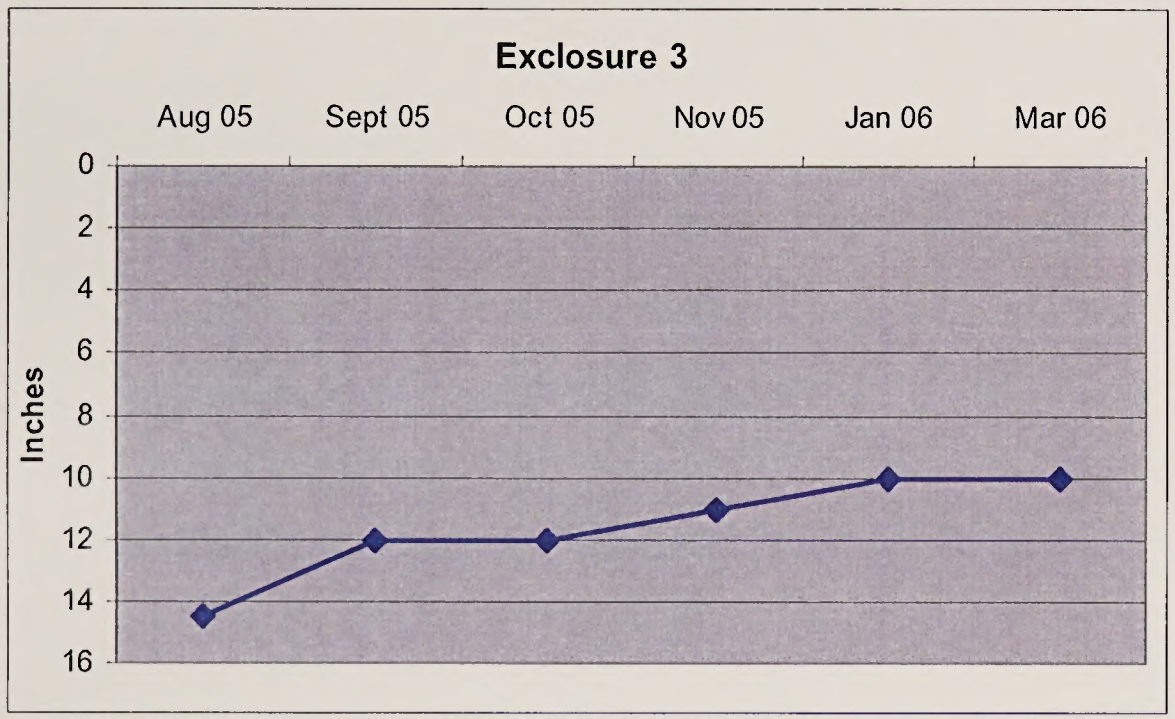
APPENDIX D

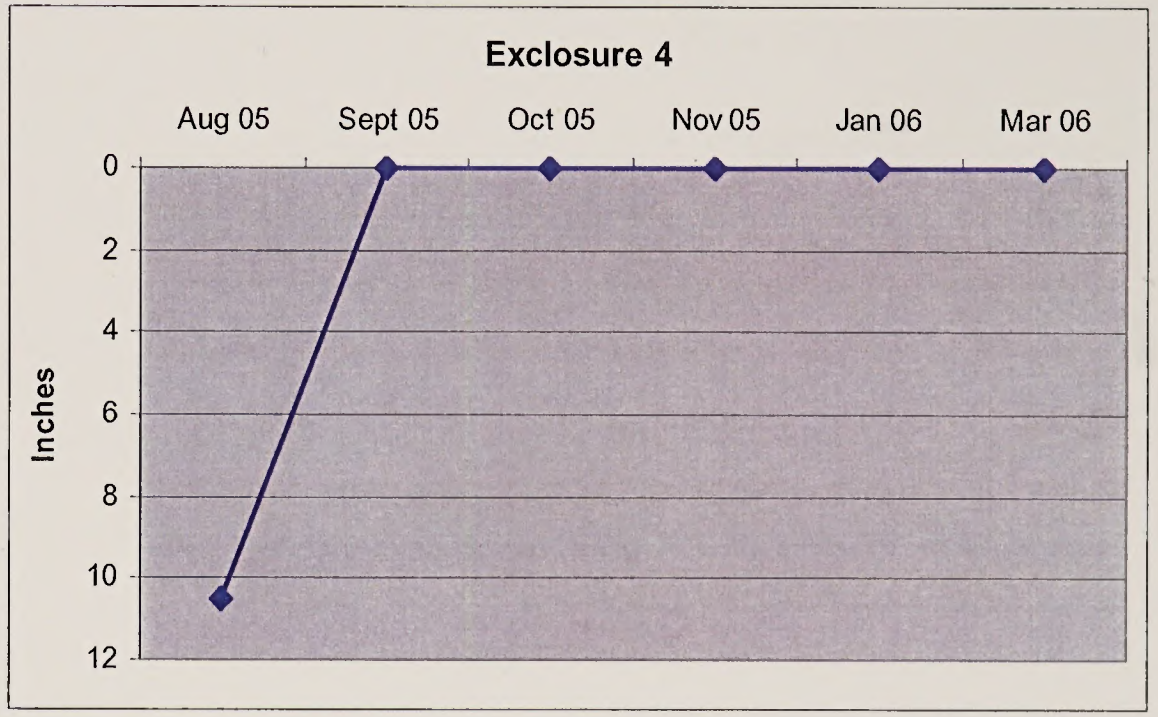
Groundwater monitoring results

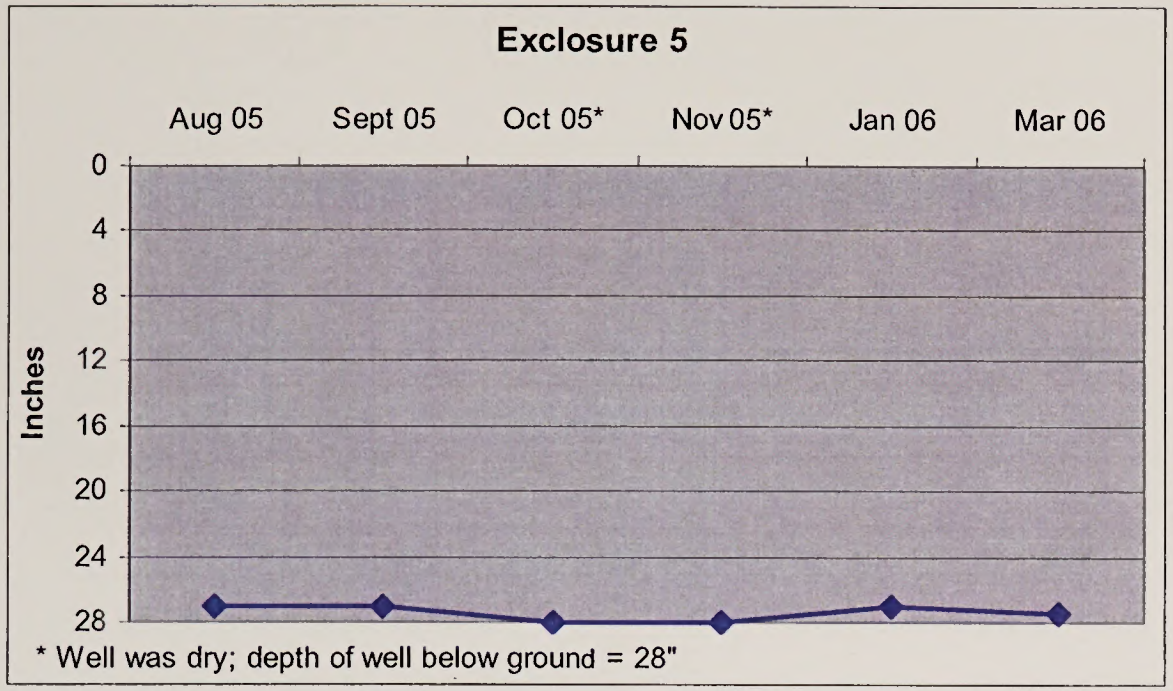
The following figures show the water level below ground in inches at individual exclosures and all exclosures combined. The ground surface is at 0 inches.

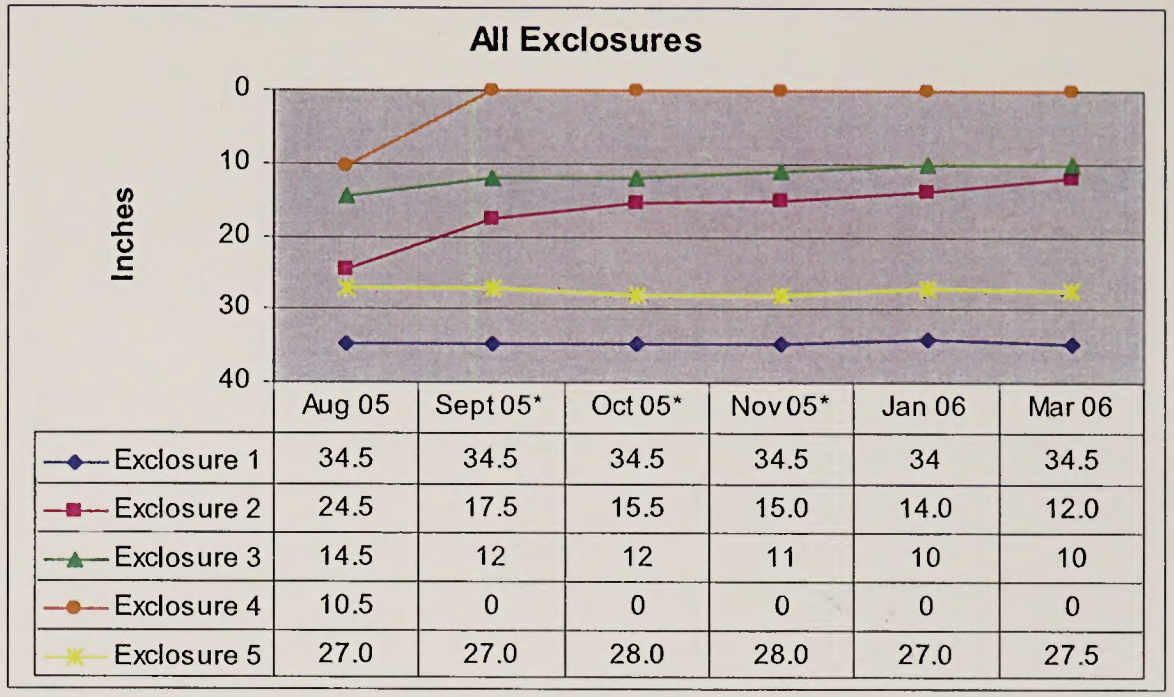












	Aug 05	Sept 05*	Oct 05*	Nov 05*	Jan 06	Mar 06
Exclosure 1	34.5	34.5	34.5	34.5	34	34.5
Exclosure 2	24.5	17.5	15.5	15.0	14.0	12.0
Exclosure 3	14.5	12	12	11	10	10
Exclosure 4	10.5	0	0	0	0	0
Exclosure 5	27.0	27.0	28.0	28.0	27.0	27.5

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